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THE SUPPLY OF AGRICULTURAL INPUTS IN JAMAICA, 1970-1980

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TABLE OF CONTENTS

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I. Introduction

The agricultural sector is of major importance in developing economies. The significance of the sector derives from its employment of labour and other domestic factors of production, from its role in supplying domestic foodstuffs and raw materials, from its net foreign exchange earnings, and from the income surpluses it generates for use both within the agricultural sector itself and within other sectors of the economy. The magnitude of these contributions depends upon the level and efficiency of input use in agriculture in response to product and factor prices, to technological developments, and to non-price policies of governmental agencies.

This report examines the supply of agricultural inputs in Jamaica during the period 1970 to 1980. The intention is to document and assess the importance of trends in the

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supply and prices of agricultural inputs in the context of the recent performance of the agricultural sector. Some policy implications are identified.

The first substantive section of the report examines the economic performance of the agricultural sector. Remaining sections describe and appraise the structure of input use, trends in supply of agricultural inputs, the current system of distributing these inputs, and trends in input prices. The final section pulls together the main findings and suggests some policy initiatives.

II. Recent Agricultural Performance: Trends and Issues

1. The Importance of Agriculture in the Jamaican Economy

Agriculture occupies an important place in the Jamaican economy. One index of its importance is the percentage share of agriculture in Gross Domestic Product. Between 1970 and 1978, agricultural GDP at factor cost in constant prices (base year = 1970) averaged 7.5 percent of total gross domestic product. The corresponding percentage share during 1960 to 1969 was 9.8 percent. Thus despite substantial economic diversification (particularly through import substituting industrialization, tourism and construction) during these two decades, the agricultural sector though experiencing a modest relative decline, still retained its importance as a contributor to gross domestic product.

In 1978, the sector ranked fifth in terms of this index, the four larger sectors being commerce (17%), mining and quarrying (14%), public administration (14%) and manufacturing (12%).

As an employer of labour, agriculture's contribution is even greater. Between 1974 and 1975, this sector employed 35 percent of the employed labour force, compared to 15 percent by public administration, 12 percent by commerce, 11 percent by manufacturing and only 1 percent by the mining and quarrying sector. In a context of serious unemployment - open unemployment rates rising from 22 percent in 1972 to 31 percent in 1979 - the labour absorption performance of agriculture is of considerable economic and social significance. However, the final demand linkages of this large share in employment are somewhat reduced by the fact that labour payments in agriculture are much lower than payments in the other major sectors. For instance, real labour incomes in agriculture were 44 percent of real labour incomes in manufacturing, 62 percent of that in construction, 63 percent of that in commerce, 26 percent of that in public administration, and 0.7 percent of that in mining which accounted for only 1 percent of the employed labour force. The relatively poor standing of agriculture in this respect is attributable to lower rates of labour remuneration in agriculture, the latter variable itself

being partly determined by lower labour productivity in the sector. Real incomes per worker are 18% of the national average; and per worker GDP is 25%. An improvement in labour productivity is necessary for any substantial increases in agricultural labour incomes. The transformation of agricultural production technology by more intensive use of improved inputs is an essential requirement for sizeable and sustained increases in labour productivity. Consequently, factors affecting the availability of and the demand for these inputs assume major policy significance.

In terms of its contribution to gross foreign exchange earnings, the agricultural sector ranks third in importance. In 1978, agricultural exports amounted to J$196 million or 18 percent of total exports. Sugar and bananas are the main agricultural export commodities, with sugar accounting for 53 percent, and bananas for 14 percent of total exports of domestic agricultural commodities in 1978. Other crops such as citrus, cocoa, coffee, pimento, and tobacco are of lesser quantitative importance. To some extent, domestic agricultural output is substitutable for imported agricultural goods. Livestock products provide a ready example. Nonetheless the economy expends substantial sums annually on imported agricultural commodities (J$260 million in 1978). By further substituting domestic products for imports, agriculture can improve its contribution to foreign exchange savings.

2. Trends in Agricultural Performance

The objective of this section is to depict the main trends in agricultural sector performance. The trends outlined will be related to the input supply situation in a later section of the report.

Table 1 shows the levels of the gross domestic product of agriculture, forestry and fishing during the 1970s. Money values are expressed in constant prices (1970=100). It can be seen from column 1 that agricultural GDP stagnated between 1971 and 1978, ranging between J$98 million and J$109 million. As a consequence, there was no tendency for an increase in the sector's share of total gross domestic product despite the persistent decline of the latter throughout most of this period (column 2). The remaining columns of Table 1 present the values and percentage shares of several components of agricultural gross domestic product. These data show a situation of general stagnation in export agriculture, but a modestly favourable trend in domestic agriculture.

The trends in agricultural real gross domestic product reflect a dismal underlying situation for agricultural production and productivity. Table 2 presents production indices for selected commodities, while Table 3 provides productivity indices. Examining Table 2 first, it can be

Table 1. Agricultural Gross Domestic Product - at Factor Cost, 1970-1978
Constant Prices, base year 1970 (J$ Million and %).1/

Year	Agric. GDP	Total GDP	Agric. GDP as % Total	Export Agric. GDP	Domestic Agric. GDP	Livestock GDP	Export Agri. GDP as % Agric. GDP	Domestic Agric. GDP as % Agric. GDP	Livestock GDP as %
1970	89.1	1073	8.3	23.6	29.7	25.2	26.5	33.3	28.3
1971	98.2	1097	8.9	23.6	41.1	21.2	24.0	41.8	21.6
1972	100.0	1208	8.3	23.7	41.9	21.5	23.7	41.9	21.5
1973	94.7	1223	7.7	19.7	39.2	23.1	20.8	41.4	24.4
1974	95.5	1221	7.8	21.5	41.2	21.8	22.5	43.1	22.8
1975	97.3	1176	8.3	19.1	42.6	24.4	19.6	43.8	25.1
1976	92.9	1081	8.6	21.0	35.4	25.1	22.6	38.1	27.0
1977	99.5	1078	9.2	17.2	44.0	27.0	17.3	44.2	27.1
1978	108.8	1060	10.2	19.5	52.9	25.8	17.9	48.6	23.7

1/ In the breakdown of Agricultural GDP into Export, Domestic and Livestock components Hunting, Fishing and Forestry has been excluded. Thus, addition of absolutes and percentages will not equal Agric. GDP or 100%.

Source: Basic data from Department of Statistics National Income and Product Accounts.

Table 2. Indices of Agricultural Production (1970=100)

Year	Sugar	Bananas	Coffee	Cocoa	Foodcrops
1970	100	100	100	100	100
1971	102	94	127	102	142
1972	101	95	93	130	151
1973	88	80	133	115	137
1974	99	53	103	89	151
1975	96	52	159	99	150
1976	98	59	93	88	148
1977	78	60	133	90	178
1978	77	58	68	73	233
1979	70	54	181	100	194

Source: Basic data in Statistical Yearbook of Jamaica 1978, and Bank of Jamaica, Balance of Payments of Jamaica.

see that output of sugar, bananas, coffee, and cocoa declined almost continuously between 1970 and 1979. The decline in banana production is over-estimated in recent years because these statistics are based on (export) sales to the Banana Board and therefore reflect the increasing diversion of bananas to the local market. Domestic food-crop production rose gradually until 1977 when recorded production figures shot up. The output statistics in this instance are also very likely overestimated, being based on cultivated acreage reported by extension agents whose accuracy is now suspect as a result of production surveys conducted by the Ministry of Agriculture. Land productivity data are not readily obtainable for most crops. However, the data available for sugar cane production and for domestic food crops (Table 3) indicate a declining productivity trend for sugar cane and an upward trend for domestic foodcrops.

Production data for livestock products are reported in Table 4. A significant degree of under reporting probably obtains here, since not all slaughtering and production takes place under the purview of official agencies. Nonetheless, provided that the degree of error remains constant, the reported data do provide a reasonable indication of trends. It is evident that from 1975 the production of beef and veal and of eggs has been declining. Goat meat (a substitute for

Table 3. Indices of Land Productivity (1970=100)

Year	Sugar Cane	Foodcrops
1970	100	100
1971	94	108
1972	92	105
1973	91	108
1974	90	109
1975	83	115
1976	87	107
1977	85	117
1978	94	122
1979	89	126

Source: Same as Table 2.

TABLE 4. MEAT AND DAIRY PRODUCTION

Year	Beef & Veal (000 lb)	Goat Flesh (000 lb)	Pork (000 lb)	Poultry (000 lb)	Milk (Million Qrts)	Eggs (Million)
1970	27,400	n.a.	15,071	32,000	43 (12)[1/]	146
1971	25,800	n.a.	11,113	38,000	42 (12)	159
1972	27,117	2,228	15,020	40,000	41 (13)	123
1973	29,063	1,889	21,213	38,000	41 (12)	136
1974	28,128	417	9,621	36,000	43 (12)	139
1975	31,169	31	11,261	59,800	43 (12)	147
1976	27,212	531	14,763	59,137	42 (14)	162
1977	27,233	964	17,430	65,726	41 (15)	152
1978	25,574	707	16,746	67,767	43 (16)	157
1979	25,177	674	13,804	70,000	40 (18)	150

[1/] Number in parentheses refers to milk delivered to two processing plants and the condensary for 1970-73 and to three processing plants and the condensary for 1973-79.

Source: Social and Economic Survey, various years.

beef) after increasing greatly between 1975 and 1977, has started to decrease. Pork production, historically unstable in Jamaica, rose between 1975 and 1977, and then declined. Milk production was at best stationary. Poultry production more than doubled over the decade of the 1970s. This increase in poultry meat is one of the few bright spots in the overall picture of decline and stagnation in the agricultural sector. Possible explanations are that: 1) poultry production does not require a specific location and thus can be undertaken anywhere in Jamaica; 2) easy international transfer and adoption of technology in poultry production allows for high level technology from developed countries to be applied in less developed countries; and 3) vertical integration in the poultry industry has stimulated growth. Seventy-five percent of all local poultry meat is produced on farms where a broiler company has supplied the feed, chicks, veterinarian services and removal of broilers. Under this system risks to the poultry farmer are greatly reduced and the payment the farmer receives is for his labor time and managerial skill.

Given these production trends for both crops and livestocks, it is not surprising that Jamaica's trade balance in agriculture deteriorated from minus J$14 million in 1970 to minus J$83 million in 1978, despite some quantitative restrictions on imports. Because of production weaknesses, agricultural exports did not take full advantage of relatively favourable export price trends. Also because

of production weaknesses, import substitution in domestic food consumption did not take place as rapidly as planned. Instead, food imports remained at a high level in value terms ($69 million in 1970, $178 in 1975 and $234 million in 1978) as well as a percentage of total imports. (See Table 5 for details).

Several explanations may be advanced for the poor agricultural performance described in this section. There is reason for thinking that the internal terms of trade as expressed by the ratio of prices of agricultural products to the prices of manufactured goods diminished. Also it is likely that the internal rates of return in agricultural investments declined (see Bourne and Graham, 1980). Examination of the availability and prices of agricultural inputs will lend support to these explanations as the supply and prices of inputs are inherent in both of the above measures. To fully appreciate the influence of conditions surrounding input supply, one must first have some notion of the structure of input use in Jamaican agriculture. Accordingly, the next section provides a brief discussion of this facet of the agricultural situation.

III. Structure of Input Use - Farm Level

The unavailability of data from the 1978 Census of Agriculture compromises one's ability to make definitive statements about the current structure of input use in

Table 5. Agricultural Imports, J$M

Year	Sect. 0,1,4 Consumption[1/]	Sect. 0 Food	Agric. Inputs[2/]	Total Agric.	Total Imports
1970	73.2	69	19.6	92.8	437.8
1971	82.6	76.6	15.5	98.2	459.8
1972	98.2	90.2	15.2	113.5	489.3
1973	130.1	115.3	15.2	145.4	615.1
1974	185.8	175.2	20.5	206.3	850.8
1975	195.2	178.4	26.5	221.7	1,021.4
1976	179.7	166.4	15.3	195.1	829.8
1977	134.1	123.5	15.4	149.6	781.6
1978	253.6	234.5	20.5	274.3	1,260
1979[3/]	248.3	226.6	31.1	279.4	1,754.4

1/ Sections 0, 1 and 4 refer to standard trade commodity classifications in international trade statistics. In this case 0 refers to foodstuffs, 1 refers to beverages and 4 to vegetable fats and oils.

2/ Agricultural inputs consist of current inputs (i.e. fertilizers, chemicals, planting materials) and capital inputs (i.e. tractors and dairy milking machines).

3/ Provisional.

Source: External Trade, Department of Statistics, various years.

Jamaica. However, some description can be attempted on the basis of small farm surveys conducted in 1979, 1980 and 1981 by the authors of this report, and by Begashaw (1980), and on the basis of impressionistic evidence for large farms, especially sugar estates.

Begashaw (1980) surveyed 422 farms drawn from the total set of Self-supporting Farmers Development Loan Program clients in 1979. These farmers are small and medium sized i.e. 5 to 25 acres large. The survey results established that many Jamaican farmers use modern inputs. Even prior to receipt of development credit (which increases the relative usage of modern inputs), 53 percent of the sample utilized both manufactured fertilizers and chemical inputs, 46 percent made use of veterinary services, 59 percent planted improved seeds, 39 percent raised improved breeds of livestock, and 66 percent of the farmers practiced soil conservation. Irrigation was the only modern input hardly used by Jamaican farmers; only 6 percent admitted to its use. For more details see Table 6.

A somewhat fuller understanding of the relative levels of input use is possible on the basis of the OSU-ISER survey conducted among farmers in St. Elizabeth and St. Catherine in 1979. These two regions together typify most, if not all, of the small farm characteristics of Jamaican agriculture in terms of terrain, climatic conditions,

Table 6. Modern Input Use By SSFDP Farmers

Input	Used Before and After Loan		Used Only After Loan		Never Used		Total	
	No.	%	No.	%	No.	%	No.	%
Fertilizer	206	52.8	151	38.7	33	8.4	390	100
Chemicals	201	53.2	146	38.6	31	8.2	378	100
Verterinary Services	139	45.7	84	27.6	81	26.6	304	100
Improved Breeds	126	38.8	152	46.7	47	14.5	325	100
Improved Seeds	219	58.9	106	28.5	47	12.7	372	100
Irrigation	20	4.9	15	3.6	374	91.0	411	100
Soil Conservation	239	65.6	124	34.1	1	0.3	364	100

Source: Table 7.5, Begashaw (1980).

crop mix, production and marketing arrangements and practices, and credit market participation. The St. Elizabeth random sample contained 185 farms and the St. Catherine sample contained 283. The sample survey results are presented in Table 7. From these results it is clear that hired labour is the single most important input in both regions, being used by nearly 50 percent of all farmers and representing the largest input expense. Next in importance is farm machinery for St. Catherine farmers, and manufactured fertilizers for St. Elizabeth farmers. Sizeable expenditures are also made on livestock feed, power (very important for poultry growers), chemical pesticides, fungicides, weedicides, and hired transport.

The structure of input use described pertains to farms 50 acres or less. This size category represented 99.3 percent of farm holdings and 43 percent of acreage at the time of the 1968/69 Census of Agriculture. The current shares are most likely larger in view of the breakup of some large estates under the several land reform initiatives taken by the PNP administration between 1972 and 1980. For the large farmers, it can be safely surmised that relative usage of modern inputs is greater. While it can be concluded that Jamaican agriculture uses those modern inputs which generally improve agricultural productivity and output, it is unclear whether the use of such modern inputs of all

Table 7.1. Number of Farmers with Input Expenses by Type of Expense and Selected Measures of Distribution (Sample Only)

St. Catherine Area

Type of Expense	# Farmers	Mean	Median	Mode	STD. DEV.	Coef. of Var.
Hired Labor	129	$661.91	$100.31	$100.00	$3,684.39	5.57
Farm Machinery	4	620.00	37.50	30.00	1,146.84	1.85
Hired Transport	38	107.97	40.50	50.00	152.06	1.41
Farm Tools	136	33.65	20.17	6.00	42.87	1.27
Fertilizer	59	276.05	64.00	17.00	1,263.25	4.58
Chemicals	44	127.16	50.17	20.00	360.36	1.30
Livestock Feed	70	326.80	76.50	10.00	1,110.52	3.40
Seeds, etc. (Non-perm. Crops)	98	34.12	10.39	2.00	53.34	1.56
Power	23	437.61	50.00	30.00	1,224.16	2.80
Vet. Services	8	76.75	14.50	1.00	171.66	2.24
Rent (on land)	68	43.21	20.25	10.00	101.93	2.36
Insurance	1	6.00	6.00	6.00	-	-
Other	4	$359.00	$ 93.00	$ 50.00	$ 561.04	1.56

Source: Graham, Bourne, et. al., 1980.

Table 7.2

St. Elizabeth Area

Input Expense	No. of Farmers Undertaking Expense	($) Mean	($) Median	($) Mode	Std. Dev.	Coefficient of Variation
Labor	107	1173	315	200	2537	2.16
Machinery	35	138	70	80	222	1.60
Transport	72	110	55	50	182	1.65
Fertilizer	139	369	180	120	657	1.78
Chemicals	124	195	74	200	466	2.39
Seeds	106	70	30	20	139	1.98
Power	30	47	25	30	65	1.38

Source: Same as Table 7.1.

farmers is at the optimal level. Moreover, a constrained supply situation implies that not all demand is met for modern inputs so that some farmers who would use such inputs are not. Consequently, trends in the availability and prices of these and other inputs must have had some influence on agricultural performance. We now turn to an examination of input supply.

IV. The Marketing Structure for Modern Agricultural Inputs

The marketing structure for modern inputs is oligopolistic, particularly at the wholesaling end of the spectrum. There are 7-8 firms that are engaged in the importation and wholesaling of modern inputs. These primary importers and wholesalers are based in Kingston and distribute to many retailers scattered throughout the country. There are only two importers of fertilizers in Jamaica - Antilles Chemical Company and Shell Chemicals Company. The former imports components and crude fertilizers and mixes them locally; the latter imports premixed fertilizer. Imports of chemicals are handled mainly by four companies, which in 1977 were responsible for 75% of total imports of chemical inputs. From 1975, Jamaica Nutrition Holdings has been the monopoly importer of all grain used as the basis for local animal feed production. Local production itself is done by three firms. The market share of the largest of the three local

producers of animal feed is forty-seven percent, while the other two have approximately twenty-six percent each. Capital goods are imported and wholesaled by two companies each in the case of handtools and capital equipment. The two firms in handtools accounted for 66 percent of imports in 1977. Those in capital equipment, such as dairy milking machines, tractors, etc., accounted for 82 percent of imports in 1977.

Two important organizational changes occurred in the 1970s. First, producer organizations became direct importers on a small scale. In the past, producer organizations, such as the Cane Farmers Association and the All Island Banana Growers Association would request and be allocated specific quantities of fertilizer from the wholesalers. With the reduced supply caused by foreign exchange rationing, this arrangement became unsatisfactory to the producer organizations which experienced difficulties in obtaining the quantities desired. Consequently, the Cane Farmers Association and All Island Banana Association persuaded the government to grant them licenses for direct importation on a large scale in 1980 (see Table 12, p. 31).

The second important organizational change is that the government became the monopoly importer of grain for livestock feeds. Jamaica Nutritional Holdings-apublic sector corporation-was established and entrusted with the function of grain imports for human and animal consumption. The

JNH has attempted to minimize the cost of food and animal feeds by seeking out lowest cost sources of grain from overseas. The government import trading corporation - The State Trading Corporation - was to have become the sole importer of handtools in 1980. However, the STC effort was unsuccessful in this attempt, as not all handtools were imported by the STC. Those handtools imported by the STC were distributed by the Jamaican Agricultural Society (JAS) through its retail outlets.

The JAS (along with the Jamaican Livestock Association) is the only importer of agricultural inputs that has retail outlets island wide. It was intended that the JAS would become the distribution arm of a centralized importation system, the STC being solely responsible for the importation of all agricultural inputs into Jamaica. This involvement of the JAS in marketing agricultural inputs may in part be due to pressure by the JAS leadership for a more participatory role in the agricultural sector. The JAS has lost many of its services it once provided to the farming community and has frequently pressed government for a return to its leading role. JAS maintains retail outlets for inputs in every parish. However, about one half of these outlets are now closed and thus JAS is unlikely to be able to fulfill its expected role. Indeed the closure of these outlets also affected the JAS ability to efficiently distribute the STC importation of handtools.

An oligopolistic market structure for agricultural inputs has the potential for the adoption of pricing and supply policies which are not necessarily conducive to agricultural modernization, output growth, or equity. In practice, the inputs being discussed here are subject to price controls imposed by the Jamaican Government. The nature and effectiveness of the price control machinery will be returned to in the section dealing with input prices. The major potential problem emanating from corporate supply policy is the adoption of non-price rationing criteria as a means of allocating scarce commodities. Where input suppliers have a close economic relationship with particular groups of agricultural producers, those groups will be given preferential treatment. This is the case with bananas and sugar cane where the importers are grower organizations, and with broiler meat production. The largest feed producer is also the largest broiler producer. As a broiler meat producer, this firm supplies chickens and the requisite inputs to farmers who contractually raise poultry on behalf of the firm. These poultry farmers naturally receive preferential treatment in times of input scarcity. That poultry farmers outside of this privileged relationship can be seriously affected is seen from recent reports (Daily Gleaner, March 22, 1981) that independent

poultry farmers are reluctant to purchase baby chickens from the Jamaica Livestock Association because of uncertainty surrounding the availability of animal feed.

V. Supply Trends for Agricultural Inputs

Trends in the availability of agricultural inputs were very irregular during the period 1970-1979, with strong tendencies towards decline from 1976 onwards. This means that agricultural output and productivity were constrained by problems of resource availability not only in terms of the quantum of resources but also in terms of the quality of inputs as farmers are forced to substitute inferior inputs and to use these inputs beyond their optimal points. Supply trends of the main inputs are now outlined.

Data on land use provided by the 1968/9 census of agriculture conducted by the Department of Statistics and from the Ministry of Agriculture's crop production surveys reveal that acreage under agriculture declined between 1968 and 1979. This was partly in response to uncertainty surrounding the government's land reform policy and probably also in response to the declining profitability of agriculture (about which we shall say something in Section VII. Whatever the reason, as Table 8 shows, total acreage diminished from 1,489,188 in 1968 to an estimated 1,240,046 acres in 1979. There were significant shifts

Table 8. Changes in Land Use 1968-1979, All-Island

Farm Size	Total Acres 1968 1/	Acres 1979 2/
Under 1 Acre	22,736	2,186.5
1 to Under 5 Acres	206,480	88,112.9
5 to Under 25 Acres	340,757	233,242
25 to Under 100 Acres	127,208	199,959
100 Acres and Over	792,007	722,545
TOTAL	1,489,188	1,240,046

Notes: 1) 1968 Data is from the Agricultural Census 1968/9.

2) 1979 Data is from Crop Production Survey, Data Bank First Quarter 1979. Also, the Farm Size Distribution for 1979 needs to be viewed with caution due to survey method employed, but the totals can be viewed as precise estimates.

in the size distribution of farm land, as can also be seen from Table 8. Acreage in medium size farms (5 to 25 acres large) decreased significantly as did acreage in the 1 to 5 acres and "greater than 100 acres" categories. The gainers were the "25 to 100 acres" group.

In contrast to the trend of land, the agricultural labour force tended to increase, declining only in 1979 (Table 9). This trend partly reflects the greater participation of the State in agricultural production either directly or indirectly through worker cooperatives in sugar, and the land lease projects. Given the greater labour intensity of state production (because of its employment creation bias), increasing production by the State implies relatively greater labour absorption. Another explanation is the growth of disguised rural employment as service workers and directly productive workers in urban centers emigrated to rural districts when urban employment contracted. It is pertinent to note that, except for 1978 (the year for which agricultural output figures should be treated with utmost caution, as pointed out earlier), real agricultural GDP per worker and real agricultural GDP tended to decline in the late 1970's compared to the early 1970's. This suggests that the growth in agricultural employment did not contribute particularly to agricultural output.

Manufactured fertilizer is one of the main modern inputs in agricultural production. Jamaica imports all of

Table 9. Agricultural Labour and GDP 1969 to 1979

Table	Agricultural Labour Nos.	% Total Labour	Real Agric. GDP $M	Real Agric. GDP Per Worker $
1969	236,900	38.4	86.7	n.a.
1970	n.a.	n.a.	89.1	n.a.
1971	n.a.	n.a.	98.2	n.a.
1972	204,350	33.4	100.0	458.8
1973	202,000	32.0	94.7	428.4
1974	225,200	34.9	95.5	427.8
1975	226,850	33.2	97.3	428.9
1976	243,900	35.5	92.9	380.9
1977	243,950	35.4	99.5	407.9
1978	259,950	36.3	108.8	418.5
1979	248,950	29.0	91.1	365.9

Source: Basic Data from Department of Statistics National Income and Product and the Labour Force.

its fertilizer requirements. Imports fell considerably below trend after 1976, and declined overall by 23 percent over the decade. Faced with rapid depletion of foreign exchange reserves, the Jamaican economic authorities severely rationed foreign exchange thereby reducing the availability of imported fertilizers and other imported agricultural inputs.

Chemical inputs are entirely imported. The data in Table 10 (column 2) show that import volumes have fluctuated widely, for example the volume in 1973 is 5.6 times that in 1972 and about 5 times the volume in 1974. In general, however, the trend has been relatively stable between 1975 and 1979. Machinery imports are reflected by the tractor series (column 3 of Table 10). The pronounced decline in the availability of agricultural machinery is very evident. Given the slow growth of the agricultural labour force and the failure of labour productivity to increase, it must be inferred that the decline in machine availability was not compensated for by increases in labour utilization or by greater labour productivity. Hand tools, also mainly imported, have been subjected to periodic scarcity. Overall, there was a 20 percent decline between 1970 and 1979, but if 1973 import volumes are taken as a true indicator of demand, the shortage caused by the decrease between 1973 and 1979 is as much as 40 percent.

Table 10. Supply of Manufactured Fertilizers, Chemicals, Tractors, Handtools and Planting Materials, 1970-79.

Year	Fertilizer (Tons)	Chemicals (Tons)	Tractors (Numbers)	Handtools (Numbers)	Planting Materials (Tons)
	(1)	(2)	(3)	(4)	(5)
1970	68,154	1,534	587	293,360	5,215
1971	61,658	1,331	357	378,709	3,215
1972	68,301	1,611	298	254,811	2,937
1973	80,939	8,683	535	398,952	6,717
1974	56,661	1,989	338	257,679	5,742
1975	64,668	6,718	463	377,832	2,080
1976	60,520	7,297	197	107,216	5,415
1977	47,158	5,753	42	59,400	3,533
1978	44,858	7,911	79	232,773	1,776
1979	52,731	6,202	104	235,019	199
% Change 1970-79	-23	+304	-82	-20	-96

Source: Department of Statistics, External Trade Accounts.

The last column in Table 10 charts the trend in the supply of imported planting materials. Even if the dramatic decreases in 1978 and 1979 are overlooked, it is clear that considerable supply problems faced Jamaican crop farmers. Imports have been highly irregular. Though no times series information is available on locally produced planting materials, two further observations can be made. First, farmers' responses to questions during recent surveys by the authors indicate that local supply did not fully satisfy the additional demand for planting materials. Second, the diversion of crop output from current consumption to planting materials (future consumption) creates some difficulties for current final demand, especially in view of stringent quantitative restrictions on imports of food.

The final input to be examined is animal feeds. The pertinent quantitative information is presented in Table 11. Over the years, Jamaica has been able to locally produce its requirements of animal feeds, but is totally dependent on imported grain to undertake the local production of animal feeds. Total supply has expanded tremendously, increasing by 83 percent over the period. Within the last three years, supply difficulties have begun to appear. Because of foreign exchange scarcity, local producers of animal feeds have not been able to maintain the expansionary momentum evident from 1973 to 1976. Currently these producers are experiencing some excess

Table 11. Supply of Animals Feeds, 1970-79.

Year	Imports (Tons)	Local Production (Tons)	Total Supply	Imports as % Total
1970	21,242	91,030	112,272	18.9
1971	13,405	106,263	119,668	11.2
1972	12,860	120,849	133,709	10.7
1973	4,515	98,294	102,809	3.4
1974	9,434	134,498	143,932	6.5
1975	4,338	170,390	174,728	2.5
1976	3,740	197,573	201,313	1.9
1977	2,005	194,884	196,889	1.0
1978	2,677	207,403	210,080	1.3
1979	4,840	200,168	205,008	2.4
% Change 1970-79	-77	+120	+83	

Source: Department of Statistics External Trade Accounts, and Production Statistics.

Table 12. Distribution of Fertilizer By Crop Type, 1977-1980

Crop/Year	1977 Amt.	1977 %	1978 Amt.	1978 %	1979 Amt.	1979 %	1980 Amt.	1980 %
Sugar Cane	14,639	46	13,524	45	11,134	35	19,007[1/]	49
Bananas	4,446	14	5,000	17	5,647	17	8,241[2/]	21
Vegetables & Root Crops	7,503	24	6,230	21	6,991	22	6,749	17
Pasture	2,966	9	3,303	11	4,318	13	3,040	8
Miscellaneous	1,875	6	1,861	6	4,063	13	1,480	4
TOTAL	31,425	100	29,918	100	32,153	100	38,517	100

1/ Includes 3,000 tons imported by All-Island Sugar Cane Farmers Association.

2/ Includes 6,000 tons imported by All-Island Banana Growers Association.

Source: Data derived from company records of the major enterprise importing and supplying fertilizer to agricultural producers, (i.e. Antilles Fertilizer Co.).

capacity. Nonetheless, the global supply situation with respect to animal feeds is clearly not half as severe as that pertaining to other agricultural inputs.

The incidence of input supply difficulties has not been uniform across all types of agricultural enterprises or across all farm sizes. The main export enterprises have had better success in securing their requirements, than have domestic foodcrop producers. Table 12 on fertilizers illustrates the crop incidence of input shortages. There, it can be seen that vegetables and root crops have secured decreasing proportions of fertilizers sold by one major distributor. Export crops such as sugar cane and bananas at least maintain their respective shares, partly because of direct imports through their growers' associations.

As far as the incidence of shortages on farms of various sizes is concerned, first we note that medium and large size enterprises predominate in the cultivation of sugar cane and bananas, while cultivation of vegetables and root crops is mainly by small farmers. Second, one major distributor of animal feeds reported that in cases of shortages of livestock feeds, large bulk purchases (i.e. large farmers) get priority over small purchasers (i.e. small farmers).

VI. Input Prices

In addition to problems caused by input scarcity, farmers have also had to contend with rapidly rising prices for all variable inputs. These prices have tended to rise faster than farmgate prices thereby depressing net returns and forcing many farmers into a loss situation. In this and the next section, we detail the trends in input and farmgate prices. The role of price controls and subsidies is also examined.

Wage rates in agriculture increased tremendously between 1970 and 1980 as seen through reports from the Sugar Producers Association, Citrus Growers Association and recent farm surveys by Ohio State University. These sources indicate that daily wage rates of $1.20 were reported in 1970 for hired farm labour. These wage rates rose to $2.50 in 1974 and increased still further to $8.00 in 1979 and $10 in 1980. Through the process of wage rate negotiation, wage rates are indexed to the consumer price level. Thus movements in consumer prices are reflected (after some delay) in movements in wage rates. Wage rates established in the unionized subsectors, especially sugar cane growing and sugar manufacturing, set the norm for expected labour payment in the non-unionized, predominantly small farm subsectors. As a consequence, wage rates for the entire agricultural sector, and not just the unionized components, tend to parallel the consumer price level.

The nominal and real unit import prices of selected agricultural inputs are shown in Table 13. The nominal prices are implicit prices calculated by dividing the C.I.F. values of imports by the quantities imported. The nominal prices are then deflated by the implicit GDP deflator to arrive at the real prices. The reason for this deflation is that in times of rapid inflation nominal prices do not reflect the real effects of input price changes. Since dealers' margins, subsidies and price controls are not adjusted for, the unit import prices are not equivalent to local retail prices. Moreover, we suspect that there are some errors in the source data in some years. Nonetheless, the movements in the import prices do provide reasonable indications of the trends in local retail prices.

Imported inputs were subjected to significant price inflation as reflected in increases in the nominal prices (Table 13, Panel A). However in real terms the increases in real input prices are not as dramatic as the increases in nominal prices. For example, the nominal import prices for fertilizers trebled between 1970 and 1974, and almost doubled again by 1979.

The real price of fertilizer declined until 1974, when it doubled and then declined and rose slowly towards the end of the 1970s. In real terms the increase in fertilizer prices was only 40 percent.

Table 13. Panel A--Nominal Units Import Prices of Selected Inputs

Year	Fertilizer $ per ton	Chemicals $ per ton	Animal Feeds $ per ton	Handtools $ per unit	Planting Materials $ per ton
1970	42	1,055	131	0.74	116
1971	42	1,318	153	0.78	130
1972	42	1,155	161	0.81	148
1973	48	375	391	0.99	106
1974	147	1,754	225	1.80	309
1975	147	704	402	1.83	499
1976	77	677	579	2.22	281
1977	109	865	668	2.15	707
1978	158	946	690	2.92	915
1979	220	1,499	1,068	4.44	n.a.
	Panel B--Real Unit Import Prices of Selected Inputs[1/]				
1970	42	1,055	131	0.74	116
1971	39	1,232	143	0.73	121
1972	38	1,060	148	0.74	136
1973	37	291	303	0.77	82
1974	87	1,038	133	1.06	183
1975	82	389	222	1.01	276
1976	34	296	253	0.97	123
1977	43	338	261	0.84	276
1978	49	294	214	0.91	284
1979	59	404	289	1.20	n.a.

[1/] Nominal unit import prices deflated by implicit GDP deflator (1970=100).

The nominal price for chemicals rose by 40 percent between 1970 and 1974. After 1974, there seems to have been a compositional change which affected nominal unit values, but comparing the nominal price for 1979 with that of 1975, it is clear that a very large price increase (100 percent) occurred over the second half of the decade.

However in real terms the price of chemicals experienced a sharp decline after 1974 and the real price in 1975 is approximately the same as that in 1979. Animal feeds were also subject to significant price inflation, increasing from $131 per ton in 1970 to $402 in 1975 and $1068 in 1979. No less substantial increases took place for nominal prices of planting materials and farm implements. The latter experienced nominal price increases of nearly 300 percent between 1970 and 1976, and 200 percent between 1976 and 1979. The former experienced nominal price increases of almost 300 percent in each of the sub-periods, 1970 to 1974, and 1974 to 1978. Again, in real terms, the price increases are much less substantial for animal feeds, handtools and planting materials than the nominal prices tend to show.

The Jamaican Government developed two main lines of policy in its efforts to restrain retail price inflation for these inputs. One policy intervention took the form of subsidies. Subsidy schemes existed prior to 1970, but this report deals exclusively with the 1970s when direct

subsidies were largely for current production inputs, unlike the 1960s when farm buildings and other capital investments were favoured. During the decade of the 1970s, extensive direct subsidies have been granted for fertilizers, animal feeds, planting materials, and machinery. Table 14 presents some estimates for fertilizers, animal feeds, and planting materials. These estimates provide some indication of the magnitude of subsidies.

Fertilizer subsidies which accrue to importers were 20 percent of CIF import values until 1974 when they were raised to 33 1/3 percent. These rates of subsidy substantially lower retail prices for this type of commodity. However, the subsidy benefits on fertilizer usage do not accrue equally to all types of enterprises and all sizes of producers. The fertilizer subsidy scheme is developed mainly for the benefit of cane farmers and banana growers.

The animal feed subsidy program was finally discontinued in its explicit direct form in 1975, but was already being phased out in 1973. The main reason for this change in policy was the budgetary difficulties of the government. However, an implicit subsidy provision still exists so long as Jamaica Nutrition Holdings continues to absorb some of the wharfage and handling charges associated with imported animal feeds.

Planting material subsidies have generally been provided within the context of resuscitating or expanding

Table 14. Estimated Direct Subsidies for Agricultural Inputs ($000)

Year	Fertilizers	Animal Feeds	Planting Materials
1970	341	477	n.a.
1971	390	676	n.a.
1972	394	1,114	827
1973	491	2,641	983
1974	1,500	27	1,836
1975	2,729	0	1,929
1976	842	0	n.a.
1977	580	0	n.a.
1978	1,239	0	n.a.
1979	59	0	n.a.

Source: Ministry of Agriculture, unpublished data, Planning Unit.

export crops such as bananas, coffee, coconuts, and cocoa. While the outreach is normally large, the per unit cost tends to be small. For example, the coconut rehabilitation program provided 1.3 million seedlings at a total cost of $261,803 over the period 1969-1973 (per unit cost equals $0.20). The coffee resuscitation program distributed 5.5 million seedlings to 7,968 growers over a similar period, but its cumulative subsidy assistance between 1970 and 1978 amounted to only $1.2 million (per unit cost equals $0.22).

The other main policy intervention is the price control regime for agricultural inputs. Price controls are imposed on animal feeds, fertilizers, insecticides, fungicides, and handtools. Retail prices are set for animal feeds and handtools by a Price Order issued by the Minister of Industry and Commerce. Retail prices for fertilizers, insecticides and fungicides are set by the traders, subject to the veto powers of the Prices Commission. These controls are of varying levels of effectiveness depending on the type of commodity. For some commodities, the distribution network is susceptible to easy policing. For some others, it is possible for producers (or local blenders) to reduce the quality of constituent inputs as a means of increasing profit margins. Government officials identify the latter expedient as the one most practiced and least capable of effective monitoring, especially since quality inspection is the

responsibility of a separate statutory body and not the Prices Commission or the Ministry of Industry and Commerce. Despite these areas of weakness, the price control machinery has succeeded in restraining input price inflation.

VII. Farmgate Prices

Table 15 provides time series evidence on the behaviour of farmgate prices for export and domestic crops. In particular years, real farmgate prices for specific crops rose more rapidly than major input prices (Table 16). This was especially the case for the last three years of the decade. Overall, however, the annual percentage increases in farmgate prices were less rapid than wage rates but on average crop prices increased more than imported input prices.

The implications of these changes in output and input prices on agricultural profitability are better understood when information on input use by crop type is known. Such information was presented earlier. It was noted that the export crops are the biggest users of fertilizer. Clearly, the profitability of cane has been compromised by the increase in fertilizer prices and decline of cane prices. Other crop farmers who use fertilizer have fared better than cane farmers. This also implies a suboptimal allocation of fertilizer. That is, too much fertilizer is going to sugar cane and too little fertilizer to other crops given the output price to fertilizer price ratios.

Table 15. Index of Real Farmgate Prices (1970=100)

Year	Sugar Cane	Bananas	Coffee	Cocoa	Coconuts	Food Crops
1970	100	100	100	100	100	100
1971	101	96	95	95	94	114
1972	114	95	102	89	93	115
1973	114	87	120	93	93	133
1974	111	102	143	93	95	134
1975	152	202	155	73	144	158
1976	137	163	178	86	171	135
1977	113	146	175	77	153	164
1978	88	130	271	121	162	128
1979	98	151	258	176	184	147

Source: Derived from basic data contained in Annual Commodity Board Reports, Crop Production Surveys, Ministry of Agriculture.

Table 16. Indices of Real Input Prices (1970=100)

Year	Fertilizer	Labor	Handtools	Fungicides	Insecticides	Herbicides
1970	100	100	100	100	100	100
1971	93	95	99	95	108	103
1972	91	n.a.	100	86	87	99
1973	88	n.a.	104	113	20	100
1974	207	116	143	86	90	86
1975	195	243	136	11	46	150
1976	81	n.a.	131	11	98	108
1977	102	195	114	10	111	109
1978	117	164	123	10	122	21
1979	140	181	162	14	107	21

Source: Values in Table 13 deflated by implicit GDP deflator (1970=100).

However, most of the crops experienced a decline in profitability over the 1970s due to the rapid increase in agricultural wages. Those farmers in crop enterprises employing large amounts of labor found themselves caught in a cost squeeze situation. Furthermore, the foreign exchange constraint of the late 1970s limited importation of capital inputs (i.e. tractors) that could have substituted for farm labor. More importantly, this rise in agricultural wages should have convinced policymakers and researchers to develop techniques that would have increased labor productivity. Increases in labor productivity could have been accomplished through mechanization or improvement of crop yields. However, this did not occur as shown by the data in Table 3. One reason for low yields (and thus low farm labor productivity) may be due to the suboptimal allocation of fertilizer noted above.

The indices of real prices of chemical inputs are presented in Columns 3-6 in Table 16. There have been increases in the real prices of insecticides and herbicides and a dramatic decrease in the real price of fungicides. This phenomena is also reflected in the imports of these chemicals, as fungicides make up approximately 70 - 80 percent of the total quantity of chemical imports. Thus, importers have supplied farmers with the cheapest chemical. What is curious is that there does not appear to be a fungi problem

among farmers crops. This was brought out in surveys undertaken by the authors as farmers have commented on insects and weeds as the major problems that could be handled by use of chemicals (insecticides and weedicides). Therefore, efficiency and output would increase if the composition of imported chemicals was changed. Use of more insecticides and weedicides by farmers would also be profitable as most real farm prices have increased faster than insecticide and herbicide prices.

Additionally, there are the impacts of output and input prices on farm classes within the farming sector. Those farmers that use modern inputs (i.e. fertilizer and chemicals) as well as traditional inputs have been faced with declining profitability over the decade of the 1970s. Thus, medium and large farmers--the users of most of the modern inputs--have been adversely affected. Curiously, the large farmers have not been successful (or maybe interested) in inducing the government to promote technological change that would improve farm productivity and thus profitability in the long run. Rather, many large farmers have requested and received cheap credit and/or subsidies and grants to alleviate the cost squeeze position they are experiencing. Small farmers, the users of labor and handtools also appear to be facing declining profitability. Since they are not as politically strong as their large farmer counterparts, the small farmer must engage in inadequate input

substitution to "improve" their monetary profitability. Small farmers may utilize the same handtool beyond its optimal use (productivity is then hampered) and may substitute more family labor for hired labor (which causes family labor to be undervalued as possibly more could be earned on other farms as hired labor). However, this inefficient substitution causes allocative inefficiency and adversely affects agricultural productivity.

Another point of importance is that the differential or margin between export prices or local retail prices on the one hand and farmgate prices on the other hand have widened in the first seven years of the decade. See Table 17 for details. This trend in the differentials not only raises the issue of whether the growth in marketing margins between farmgate and retail or export prices are justified, but also indicates that producers have not been reaping the full benefits of rising local retail and export prices. Clearly a policy reducing the costs and risks of marketing is strongly suggested by these findings.

VIII. Conclusions and Policy Implications

The principal conclusions of this study of agricultural input supply in Jamaica during the period 1970 to 1979 can be summarized readily. Jamaican agricultural performance has been seriously handicapped, especially since 1975, by

Table 17. Percentage Difference Between Retail and Export Prices and Farmgate Prices, 1970-1978, Selected Commodities

Commodity	Years 1970	1971	1972	1973	1974	1975	1976	1977	1978
Bananas	148	155	155	274	166	80	18	68	n.a.
Cocoa*	67	67	59	98	106	138	92	138	372
Coffee*	83	122	99	123	123	66	34	22	13.5
Yams	n.a.	100	106	119	101	104	114	57	92
Tomatoes	n.a.	105	127	134	115	106	94	74	167
Cabbage	n.a.	87	172	173	125	85	51	44	94
Red Peas	n.a.	28	48	29	40	45	74	7	31
Irish Potatoes	n.a.	92	88	120	97	81	69	38	86
Carrots	n.a.	88	105	164	26	96	99	70	76

Note: Percentage Difference Measured as $\frac{\text{(Export (Retail) Price - Farmgate Price)}}{\text{Farmgate Price}}$

Source: Retail Prices--Statistical Yearbook of Jamaica.
Export Prices--Commodity Boards and Bank of Jamaica, Balance of Payments of Jamaica.
Farmgate Prices--Commodity Board and Ministry of Agriculture.

increasing difficulties in the supply of important improved inputs such as machinery, handtools, planting materials, and animal feeds. Chemical input supply has been subjected to wide quantity variations. Input prices have escalated thereby compounding problems of limited input supply. Some price increases have tended to be faster than increases in nominal and real farmgate prices for most of the period, though farmgate prices have fared better in the most recent three years.

Price control policy and subsidies by the government have succeeded in moderating input price inflation, though quality dilution of animal feeds is a means of subverting attempts at price controls. Input price inflation as well as supply shortages are partly due to government policy actions in the foreign exchange market. Specifically, foreign exchange rationing has restricted the availability of these inputs in semi-finished and finished forms.

Three major policy implications flow from this analysis. One implication is that the narrow differential between farmgate prices and unit costs of production ought to be widened (i.e. retail or export prices should be allowed to rise, free from controls) with a view to providing reasonable incentives for agricultural production. Policy towards the objective of widening the differential need not result in the long run in sizeable increases in retail prices or

export prices. The fact of widening differentials between farmgate and retail prices (or export) prices implies that the widening distributive margins should also be reconsidered and a marketing policy adopted that can reduce these margins.

Secondly, the foreign exchange constraint on input supply ought to be relaxed. The classic foreign exchange trade off here is that which encourages increased dependence on imported agricultural foodstuffs for direct consumption (as both a cause and a consequence of domestic agricultural decline) or higher levels of imports of agricultural inputs so as to improve local production of agricultural import substitutes and export commodities.

Thirdly, two changes in the distribution and marketing system for agricultural inputs may improve allocative efficiency in the agricultural sector. First, unequal access of farmers to imported input markets implies that some farmers are using more inputs for certain crops (i.e. sugarcane) than that level implied by economic profitability conditions. Creation of barriers to entry implies that unless farmers join specific growers associations, imported inputs may be denied to them. Second, more inputs should be retailed in the countryside. The retailing of inputs by the major importers means that some farmers are forced to come to Kingston to purchase inputs as the total supply is not available in farming areas. Increased availability of inputs in farming

areas would also imply a more widespread adoption and use of imported, modern inputs. This would not only improve allocative efficiency, but increase output as well.

The relaxation of the foreign exchange constraint and promoting food imports is perhaps easier and quicker, but with negative consequences for local production. Changes in product price policy and reorganization of the marketing of inputs are more complicated, time consuming, and politically difficult but are the only self-sustaining strategy for improved output and rural welfare. Other pertinent considerations which favour the relaxation of the foreign exchange constraint are the beneficial employment and equity effects associated with the revitalization of agriculture in the Jamaican economy.

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